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अनुभाग 46 प्रकाशिक पारगमनता के बदलाव को मॉनीटर करना

Indian Standard

OPTICAL FIBRES

PART 1 MEASUREMENT METHODS AND TEST PROCEDURES

Section 46 Monitoring of Changes in Optical Transmittance

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Fibre Optics, Fibres, Cables and Devices Sectional Committee, LITD 11

NATIONAL FOREWORD

This Indian Standard (Part 1/Sec 46) which is identical with IEC 60793-1-46 : 2001 'Optical fibres — Part 1-46: Measurement methods and test procedures — Monitoring changes in optical transmittance' issued by the International Electrotechnical Commission (IEC) was adopted by the Bureau of Indian Standards on the recommendation of the Fibre Optics, Fibres, Cables and Devices Sectional Committee and approval of the Electronics and Information Technology Division Council.

The text of IEC Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.
b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

In this adopted standard, reference appear to the following International Standard for which Indian Standard also exists. The corresponding Indian Standard which is to be substituted in its place is listed below along with its degree of equivalence for the edition indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
IEC 60793-1-40 : 2001 Optical fibres — Part 1-40: Measurement methods and test procedures — Attenuation	IS/IEC 60793-1-40 : 2001 Optical fibres: Part 1 Measurement methods and test procedures, Section 40 Attenuation	Identical

Only the English language text has been retained while adopting it in this Indian Standard and as such the page numbers given here are not the same as in the IEC Publication.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

OPTICAL FIBRES

PART 1 MEASUREMENT METHODS AND TEST PROCEDURES

Section 46 Monitoring of Changes in Optical Transmittance

1 Scope

This part of IEC 60793 establishes uniform requirements for the monitoring of changes in optical transmittance, thereby assisting in the inspection of fibres and cables for commercial purposes.

This standard gives two methods for monitoring the changes in optical transmittance of optical fibres and cables that occur during mechanical or environmental testing, or both. It provides a monitor in the change of optical transmission characteristics arising from optical discontinuity, physical defects and modifications of the attenuation slope:

- method A: change in transmittance by transmitted power;
- method B: change in transmittance by backscattering.

Methods A and B apply to the monitoring of all categories of the following fibres:

- class A: multimode fibres;
- class B: single-mode fibres.

Information common to both measurements is contained in clauses 1 to 8, and information pertaining to each individual method appears in annexes A, and B respectively.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60793-1-40, *Optical fibres – Part 1-40: Measurement methods and test procedures – Attenuation*

3 Reference test method

Under consideration.

4 Apparatus

Annexes A and B include layout drawings and other equipment requirements that individually apply for each of the methods, respectively.

5 Sampling and specimens

5.1 Specimen length

The minimum length of the specimen shall be such that the changes in attenuation are compatible with the resolution of the measurement apparatus, and the non-linearities at the beginning and end of it shall not affect the results.

5.2 Specimen end face

Prepare a flat end face, orthogonal to the fibre axis, at the input and output ends of each specimen.

5.3 Specimen preparation

Prepare the specimen as described in the appropriate mechanical, environmental, or other test method specified.

5.4 Reference specimen

In methods where a reference specimen is used, it shall comprise an identical kind of optical fibre or cable to the specimen and shall be linked between the optical divider and detector, as shown in figure A.1. It may be a short length of fibre. The condition of the reference specimen shall be constant during the whole test.

6 Procedure

For individual procedures, see annexes A and B for methods A and B, respectively.

7 Calculations

For calculation procedures, see the appropriate annex: A and B, respectively.

8 Results

8.1 Information to be provided with each measurement

Report the following information with each measurement:

- date and title of measurement;
- identification of specimen;
- optical source wavelength, λ;
- specimen length;
- conditions of the environment and measurement equipment;
- changes in optical transmittance, D_η; η = 1,2,3, ... preferably plotted in a graph versus test parameters.

8.2 Information available upon request

The following information shall be available upon request:

- measurement method used: A or B;
- type of optical source used and its spectral width (FWHM);

- launching technique used;
- description of all key equipment;
- details of computation technique;
- date of latest calibration of measurement equipment.

9 Specification information

The detail specification shall specify the following information:

- type of fibre to be measured;
- failure or acceptance criteria;
- information to be reported;
- any deviations from the procedure that apply.

Annex A
(normative)

Requirements specific to method A – Change in transmittance by transmitted power

A.1 Apparatus

A.1.1 General

The arrangement shall provide a monitoring for optical transmittance with high resolution and good stability over the time and temperature changes given in the relevant product specification.

Figure A.1 is an example of a typical arrangement suitable for use when carrying out mechanical or environmental tests in a laboratory or factory. By comparison with a reference sample, it provides a measurement of the change in optical transmittance, corrected for any changes that might occur in the optical source. Connections shall have stable coupling conditions.

Figure A.2 is an example of a typical arrangement suitable for use in the field, laboratory or factory where long-term tests are required, in cases where it is possible to stabilize the optical source by optical feedback. If the stability of the optical source is compatible with the accuracy needed for the measurement, then the insertion loss measurement method (method B of IEC 60793-1-40) may be used.

A.1.2 Optical source

Use an suitable source such as a laser or light-emitting diode, emitting at wavelengths compatible with the optical fibres under test. It is customary to modulate the optical source and wavelength selective optical filters may be used.

A.1.3 Optical divider

The optical divider shall have a splitting ratio that remains constant during the test. The splitting ratio and temperature stability shall be as shown in the relevant detail specification. Commercially available or custom built devices may be used.

A.1.4 Optical detector

The optical detector shall be of sufficient area to intercept all of the radiated power in the output cone and shall be sufficiently linear over the optical powers encountered.

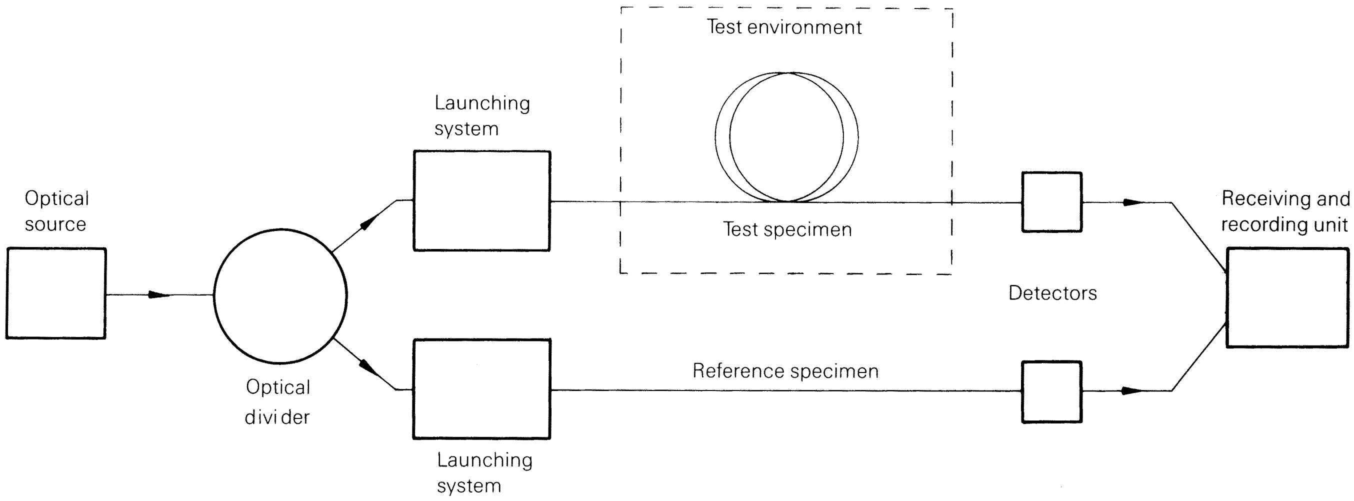

Figure A.1 – Measurement of change in optical transmittance using reference specimen

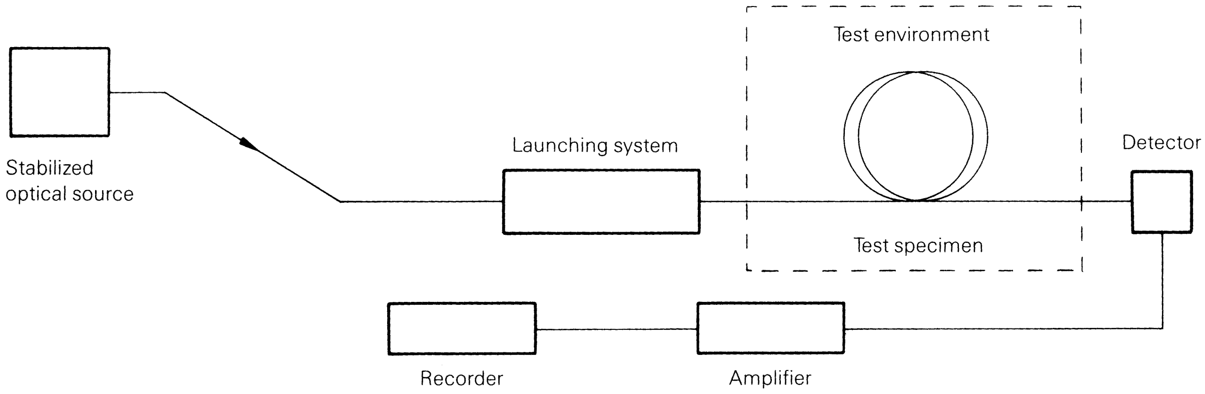

Figure A.2 – Measurement of change in optical transmittance using stabilized source

The optical detector shall have a sufficiently uniform response over the active area and range of incidence angle at the measurement wavelength to ensure the movement of the output cone in position or angle relative to the detector. This shall be within the limits determined by the mechanical design of the measurement equipment and shall not significantly affect the results.

Where more than one detector is used, as in the arrangement shown in figure A.1, the detectors shall be of the same manufacturer and model, and be of comparable linearity.

A.1.5 Launch apparatus

Provide apparatus to produce a full or restricted launch, depending on the parameter being measured, with conditions as shown in IEC 60793-1-40, methods A and B, for both multimode and single-mode fibre. Use cladding mode strippers at the source and detector ends of the specimen, and of the reference specimen if used.

A.2 Procedure

Before the test sequence, measure the initial optical power, P_{0t},, from the test specimen and, in the case of figure A.1, the initial optical output power, P_{0r}, from the reference specimen.

During the test sequence specified in the appropriate mechanical, environmental, or other test being carried out, measure the subsequent optical output powers, P_{nt} (n = 1, 2, 3, ...), from the test specimen and, in the case of figure A.1, the subsequent powers, P_{nr}, from the reference specimen.

In the above measurements, quantities proportional to the absolute power, rather than the absolute powers themselves, may be measured. In the case of figure A.1, the proportionality factor may differ between the test and reference channels. The proportionality factor(s) shall remain constant for the duration of the test sequence.

A.3 Calculations

Calculate the changes in optical transmittance during the test sequence (in decibels)

for figure 1:

$$D_n = 10 \log_{10} \frac{P_{0r} \times P_{nt}}{P_{0t} \times P_{nr}} \tag{A.1}$$

for figure 2:

$$D_n = 10 \log_{10} \frac{P_{nt}}{P_{0t}} \tag{A.2}$$

where

D_n is the change in optical transmittance during the sequence, in dB;

P_{0t} is the initial optical output power from the test specimen, in mW;

P_{0r} is the initial optical output power from the reference specimen, in mW;

P_{nt} is the subsequent optical output power from the test specimen, in mW;

P_{nr} is the subsequent optical output power from the reference specimen, in mW.

Annex B
(normative)

Requirements specific to method B – Change in transmittance by backscattering

B.1 Apparatus

See IEC 60793-1-40, method C – Backscattering.

B.2 Procedure

B.2.1 Align the fibre under test to the coupling device.

B.2.2 Analyse the backscattering power by a signal processor, and record it on a logarithmic scale.

B.2.3 Choose two points, *A* and *B*, on the curve corresponding to the beginning and the end of the fibre or cable under test.

B.2.4 If necessary, make measurements from both sides.

B.2.5 Record the following values:

- initial power levels P_{A0} and P_{B0} at points A and B (dB);
- subsequent power levels P_{An} and P_{Bn} at points A and B (dB).

B.2.6 Record the aspects of the curves for comparison before, at intervals during, and after the test sequence, as specified.

B.3 Calculations

For smooth backscattering curves, determine the change in attenuation at the different intervals of the loss curve by the difference

$$D_n = (P_{A0} - P_{B0}) - (P_{An} - P_{Bn}) \tag{B.1}$$

In other cases, take care in the interpretation of the results.

For a more detailed interpretation of results of backscattering, see clause C.5 of IEC 60793-1-40.

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Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

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